

Card), memory stick, and SMC (Smart Media Card), while maintaining the rest of the system, including the memory, corelogic chipsets, in a fully on and functional state. Secondary power saving is applied to other PC subsystems to minimize power usage still further by putting them in an idle state.

[0040] For example, with a 500 MHz Pentium III CPU having about 225 MIPS of processing power and the decode algorithm requiring about 15 MIPS, the CPU will be operating less than 10% of the time. The other 90-95% of the time the CPU will be in a standby mode that requires only milliamps of current. Alternatively, the CPU can be run at a slower clock speed, which is usually an option provided by most of today CPUs, such as the AMD's Athlon CPU. Similarly the HDD is accessed during the time it takes to fill or refill the RAM. Thus, since the average song takes about 4 minutes to play and the RAM holds about 30 songs for 120 Mbytes, and since the HDD needs 1-5 seconds to spin up and only several seconds to load the song play list into RAM, the total access time for the HDD may be 30 seconds out of 120 minutes of play time; a ratio of 1:240, less than 0.5% of full power operating time. These factors add to the power savings gained by using the mini-OS of the present invention instead of the full operating system of the portable computer. The result of the overall power consumption of the present invention is very low when the portable computer is in the music play mode, and that directly translates into the battery maintaining a useful charge level for a much longer time than allowed by the prior art. As those skilled in the art will recognize, the compressed music data of this invention may reside on a hard disk, on other magnetic (e.g., tape) media, optical (e.g., CD-ROM) media, flash media (e.g., SD cards, MMC, memory stick, SMC), or any other storage medium.

[0041] FIG. 3 is a generalized overall block diagram of an exemplary system 31 consistent with one embodiment of the present invention. The majority of the blocks in system 31 are components known in the art and are generally included in all PC computers for producing sound through the speaker of the computer. Shown here is a system clock 56, which, for simplicity of FIG. 3, is not shown connected to the various components that need a clock signal. Additionally, CPU 26 is shown interfacing with North Bridge 28. In turn, North Bridge 28 interfaces with system RAM 30 and South Bridge 32. Then South Bridge 32 interfaces with HDD 36 and CD-ROM 38. Typically South Bridge 32 also interfaces directly with Codec 42 through AC_link; however, in the exemplary system 31 shown, special purpose circuit 40 (see discussion of FIG. 4 below) is inserted between South Bridge 32 and Codec 42 to enable the playing of compressed digital audio in conjunction with the mini-OS 80 of the present invention from system RAM 30, without affecting the ability to play non-compressed analog audio. In this configuration, the mini-OS 80 is stored in the BIOS, although those skilled in the art will recognize that the mini-OS could alternatively be stored in its own ROM (either within special purpose circuit 40 or external to it), a hard disk, or other media. Thus, AC_link, from South Bridge 32 is coupled to special purpose circuit 40, which performs the decompression function as necessary, and then provides any audio signals to Codec 42 via AC_link₂. Codec 42 then performs the usual function on all signals received from special purpose circuit 40 and applies the audio signals to amplifier 44, to be played on speaker 46 or headphones (not

shown). In system 31, AC_link, looks and behaves like the standard AC_link to South Bridge 32, and AC_link₂ looks and behaves like the standard AC_link to Codec 42, making it appear to those portions of the computer that audio functions are being performed as during normal (i.e., known in the art) audio play, thus having minimal or no impact on the operation of South Bridge 32 and Codec 42. Also shown in FIG. 3 are function switches 48, small LCD display 34 and audio player power switch 54, which function as described hereinbelow with reference to FIG. 4.

[0042] FIG. 4 includes a detailed block diagram of the internals of special purpose circuit 40 and related details of the other portions of the computer that the special purpose circuit interfaces without showing all of the details of the rest of the computer system. Special purpose circuit 40 may be produced as an IC to minimize the PCB space needed to incorporate embodiments of the present invention into portable computers. South Bridge 32 is shown with the standard AC 97 controller 50 and LPC (low pin count) controller 52 to the left of special purpose circuit 40 with the standard bidirectional links AC_link₁ and LPC Bus between them, and the unidirectional IRQ (Interrupt Request) link from special purpose circuit 40 to South Bridge 32. To the right, special purpose circuit 40 provides uncompressed audio to AC 97 Codec 42 via AC_link₂. Also, to the right, function keys 48, and below LCD 34, are each shown connected to special purpose circuit 40. Additionally, FIG. 4 includes system clock 56 connected to various components, and in the lower left, audio player power switch 54. Power switch 54 is provided so that when the user initiates the player mode via power switch 54, only the mini-OS (instead of the full system OS) is initiated, for use in a system consistent with the present invention.

[0043] Internal to special purpose circuit 40 are switches 60 that interface with both AC_link₁ and AC_link₂ and function in response to settings in an internal register of register block 66, with switches 60 closed connecting AC_link₁ with AC_link₂ when the PC functions normally with the full system OS, and with switches 60 open when a system consistent with the present invention is employed. The LPC path is coupled to LPC interface. Switches 60 and AC_link₂ are coupled to state machine 64, while another port of state machine 64 is coupled, via bus 74, to the output of LPC interface 62, as well as register block 66, function key interface 68 and LCD interface 72. A second port of register block 66 is also coupled to a third port of state machine 64. Function keys 48 are coupled to function key interface 68, and LCD 34 is coupled to LCD interface 72. Also, function key interface 68 provides a signal to register block 66 when one of the function keys 48 is selected by the user. Audio player power switch 54, which is operated by the user in the second step discussed above, may be used to activate the PC to operate as described hereinabove. Switch 54 is shown connected to the DC voltage source of the portable computer and not to any particular block in FIG. 4, since that connection varies depending on several factors controlled by the manufacturer of the computer on which an embodiment of the present invention is installed.

[0044] More specifically, the blocks within special purpose circuit 40 operate as follows: